BV

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
8 March 2001 (08.03.2001)

PCT

(10) International Publication Number
WO 01/16028 A1

(51) International Patent Classification[7]: C02F 1/00, E03B 3/28

(21) International Application Number: PCT/KR00/00532

(22) International Filing Date: 25 May 2000 (25.05.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

1999/36475	31 August 1999 (31.08.1999)	KR
1999/44225	13 October 1999 (13.10.1999)	KR
1999/49008	5 November 1999 (05.11.1999)	KR

(71) Applicant and

(72) Inventor: AN, Yun-joon [KR/KR]; 102-1302 Chumdankeumho Apt., 756-5 Worlgye-dong, Kwangsan-gu, Kwangjukwangyok-si 506-302 (KR).

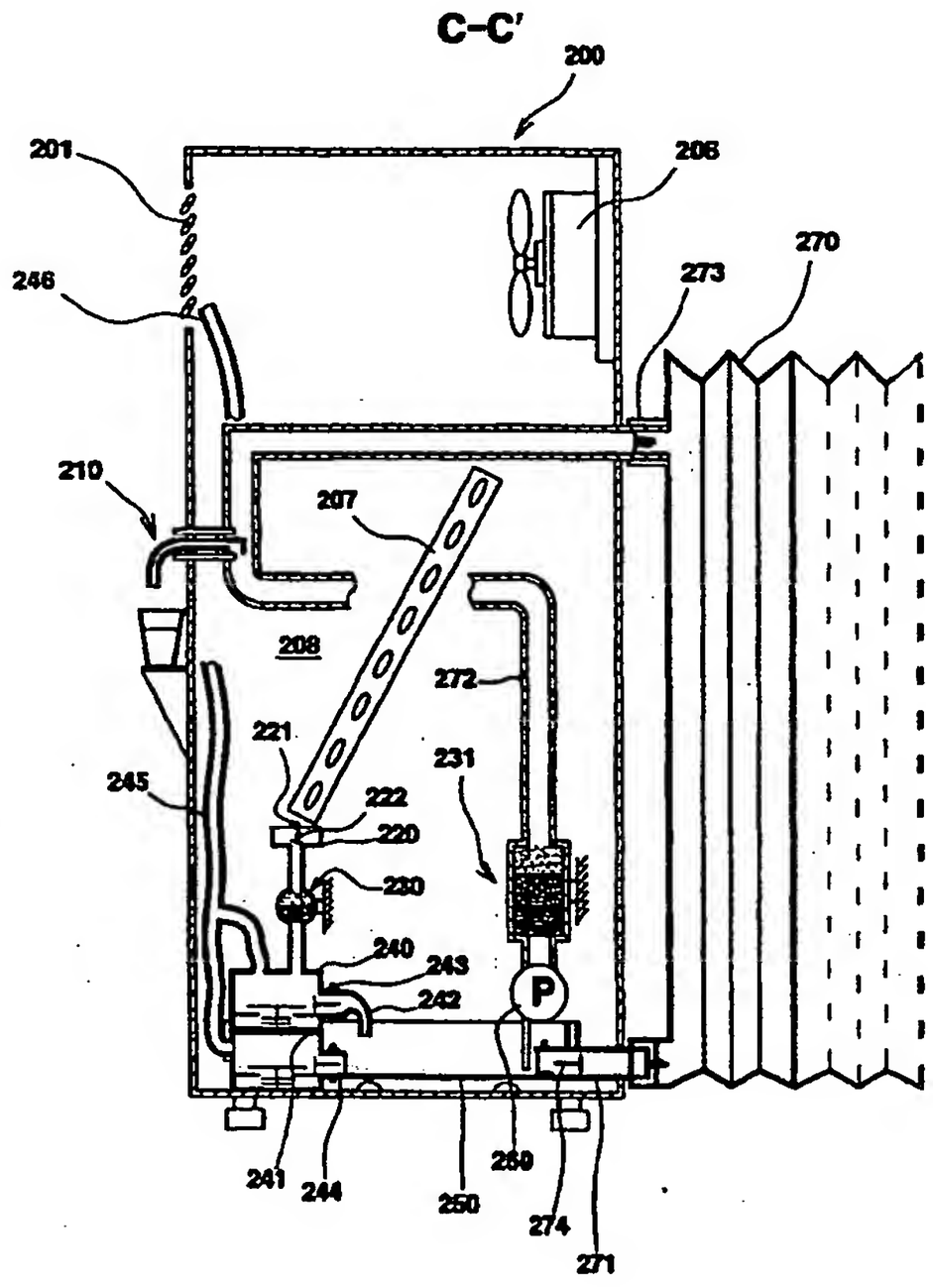
(74) Agents: JUNG, Eun-sub et al.; 5th Floor, Taekyung Building, 1337-32 Seocho-dong, Seocho-gu, Seoul 137-070 (KR).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: COOLING APPARATUS FOR MAKING DRINKABLE WATER



(57) Abstract: The invention relates to a cooling apparatus with indoor (200) and outdoor units (100) to circulate carrier gas comprising in successive arrangement a vaporizing unit (207) for collecting water condensed by an indoor unit (200), a rectangular water collecting vessel (220); a first filtering unit (230); first (240) and second (241) moisture generating units for generating moisture by vibrating the condensed water; a rectangular condensed water storage container (250) and a drinkable water storage container (270); a second filtering unit (231) piped to a pump (260); and a push-cock (210) protruded to the front side of the indoor unit (200) for draining out clean, drinkable water or for changing the direction of flowing water to the drinkable water storage container (270), so that water is condensed through a process of heat-exchanging between carrier gas and outside air, and filtered and re-used as clean, drinkable water in emergency, such as in a wrecked ship or plane, or moisture to control humidity of a room.

WO 01/16028 A1

Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

COOLING APPARATUS FOR MAKING DRINKABLE WATER

BACKGROUND OF THE INVENTION

FILED OF THE INVENTION

The present invention relates to a cooling apparatus of an air conditioner, and more particularly to a cooling apparatus for making drinkable water, which does not drain out but purify water condensed through a process of heat-exchanging between carrier gas and outside air to thereby filter and re-use the condensed water as clean, drinkable water which is also used for controlling humidity of a dry, cool room.

DESCRIPTION OF THE PRIOR ART

In general, a cooling apparatus of an air conditioner, in which atmospheric air is heat-exchanged with liquid carrier gas in evaporation, supplies cool air to cool down and de-humidify a room at the same time. The cooling apparatus with the aforementioned functions may bring about an air conditioning sickness particularly to those who are exposed to an environment air-conditioned for a long period of time. Since the cooling apparatus plays a significant role in lowering down the humidity of room air and making the room dry, people's immune system, throat and nose also get drier and weaker not to properly filter out dirt, bacteria or fungi in the room air while staying in the air conditioning environment.

In general, the cooling apparatus generates condensed water at the heat-exchanger proportionally to a relative humidity of room air while it cools down the room air. Water is condensed in the cooling apparatus by a difference in temperature of the moisture contained in the warm room air. When moisture contained in the room air suddenly cools down in a warm room, water is condensed. At this time, water is condensed in the room air just like dewdrops in the summer morning.

In the operations of a conventional cooling apparatus, the condensed water has been regarded as by-product of the cooling process to drain out through a drain-piping system or to evaporate out with the cool air of the apparatus.

In a general cooling apparatus, as disclosed in US patent No. 5,117,653, a container-shaped cooling pan assembly is provided as an exhaust cum draining unit under the vaporizing unit for collecting the condensed water. At this time, the cooling pan assembly is constructed with a draining unit integrated to an exhaust duct and a humidifier on/off controller. When the humidifier on/off controller turns on the humidifier, the exhaust-cum-draining unit of the cooling apparatus thus constructed respectively supplies cool air toward the exhaust duct so that the condensed water collected at the cooling pan assembly can drain and evaporate at the same time.

However, there is a disadvantage in the conventional exhaust-cum-draining unit of the cooling apparatus in that the condensed water is just drained out of the apparatus without being re-used.

At present, all the nations have become more and more concerned about environmental problems, reinforcing and implementing tough regulations on uses of the air conditioning equipments. In accordance with a recent international trend, there has been much research focusing on development of cooling systems or other methods to recycle the condensed water without simply draining out.

In Fig. 1, a conventional air conditioner having a humidifying function is presented as a utility model filed in Korea in 1990. In the conventional air conditioner having a humidifying function as such, the condensed water generated around a vaporizing unit 2 over an automobile draining duct 1 is collected at a humidifying duct 3, evaporated by a vibrating unit 4 to drain out through automobile draining duct 1.

In the conventional air conditioner having a humidifying function, the vibrating unit 4 is turned on to generate ultrasonic vibrations for moisture when a power

switch and a blower switch of the air conditioner are all turned on. At this time, unexplained reference numerals 7, 8 and 9 respectively indicate blower, water collecting vessel and compressing unit.

However, the conventional air conditioner dries room air through the heat-exchanging process caused by adiabatic expansion of carrier gas. If a room is air conditioner for a long period of time, the room air gets dry more rapidly.

SUMMARY OF THE INVENTION

Therefore, it is an object of the present invention to solve the aforementioned problems of rapidly de-humidifying a room by air conditioning a room for a number of hours and simply draining out condensed water, and provide a cooling apparatus for making drinkable water by filtering the condensed water to re-use the filtered, clean water as a source of obtaining water.

It is another object of the present invention to provide a cooling apparatus for making drinkable water comprising: water storage containers, pumps, a plurality of filtering units, a plurality of humidifying vibration plates and a push-cock, thereby making it possible to continuously generate moisture to supply clean, drinkable water in places hard to obtain drinkable water, such as deserts, islands, ships, crashed planes or breakdown automobiles.

Therefore, if there is any kind of energy source to bring about adiabatic expansion in a hot area by manipulating differences in temperature, the cooling apparatus of the present invention can make drinkable water by a principle of generating condensed water.

In order to accomplish the aforementioned objects of the present invention, there is provided a cooling apparatus with indoor and outdoor units to circulate carrier gas comprising:

a rectangular water collecting vessel disposed under a vaporizing unit for collecting water condensed by the vaporizing unit of an indoor unit;

a first filtering unit vertically piped under the condensed water storage container;

first and second moisture generating units piped under the first filtering unit for generating moisture by vibrating the condensed water filtered once by the first filtering unit;

a rectangular condensed water storage container piped under the second moisture generating unit and a drinkable water storage container;

a second filtering unit piped for thoroughly filtering the condensed and once filtered water of the condensed water storage container and flowing it in pressure to a pump; and

a push-cock protruded to the front side of the indoor unit for draining out clean, drinkable water thoroughly filtered by the second filtering unit or for changing the direction of flowing water to the drinkable water storage container.

BRIEF DESCRIPTION OF THE DRAWINGS

Objects and aspects of the invention will become apparent from the following description of an embodiment with reference to the accompanying drawings in which:

Fig. 1 is a schematic view for illustrating the structure of an air conditioner having a humidifying function in accordance with the prior art;

Fig. 2 is a perspective view for illustrating a cooling apparatus for making drinkable water in accordance with an embodiment of the present invention;

Fig. 3 is a cross-sectional view for illustrating the structure of the cooling apparatus for making drinkable water shown in Fig. 2, cut along line C-C';

Figs. 4A and 4B are an enlarged and analyzed perspective views for illustrating

key parts of the cooling apparatus for making drinkable water shown in Fig. 2;

Fig. 5 is an enlarged perspective view for illustrating key parts of the cooling apparatus for making drinkable water shown in Fig. 3;

Fig 6A is a cross-sectional view for illustrating the coupling state of key parts of the cooling apparatus for making drinkable water shown in Fig. 5, cut along line D-D';

Fig. 6B is a cross-sectional view for illustrating the operational state of key parts of the cooling apparatus for making drinkable water shown in Fig. 5, cut along line D-D';

Fig. 7 is a circuit diagram for illustrating the wiring state of the cooling apparatus for making drinkable water shown in Fig. 3;

Figs. 8 through 10 illustrate the operational states of the cooling apparatus for making drinkable water shown in Fig. 3; and

Figs. 11 and 12 illustrate practical uses of the cooling apparatus for making drinkable water shown in Fig. 3.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

Objects, aspects and advantages of a cooling apparatus for making the drinkable water of the present invention will become apparent from the following detailed description of a preferred embodiment with reference to Figs. 2 through 12.

As shown in Fig. 2, the cooling apparatus of the present invention of the present invention includes an outdoor unit 100 having a compressing unit for compressing carrier gas; and a condensing unit for condensing the compressed carrier gas and an indoor unit 200 having a vaporizing unit for cooling down warm room air with the carrier gas supplied from the condensing unit of the outdoor unit 100.

The indoor unit 200 of the cooling apparatus of the present invention is a

console type air conditioner assembled in a rectangular housing 208 that can be conveniently set up at one corner of office or room in a building. In the front, upper portion of the indoor unit an exhaust outlet 201 is constructed for discharging out cool air and moisture with a plurality of blades to control the direction of blowing the cool air.

Under the exhaust outlet 201, a display panel 202 is included with a power switch to control power supply, and a cooling switch and a humidifying/ dehumidifying switch to indicate operational states of the indoor unit 200. Also, a control circuit is included behind the display panel 202.

Furthermore, under the display panel 202 a push-cock 210 is protruded to the front side of the indoor unit 200 for a user to be able to take out water to drink. Under the push-cock 210 thus constructed, a cup holder 205 is provided for supporting a cup to take the drinkable water out of the indoor unit 200.

In addition, a plurality of suction inlets 204 are formed under the cup holder 205 to suck the room air while the indoor unit 200 is in operation.

As shown in Fig. 3, the cooling apparatus for making drinkable water of the present invention a cooling fan 206 is installed for blowing the air filled in the indoor unit 200 toward the exhaust outlet 201. In the middle of the indoor unit 200, a vaporizing unit 207 covering a relatively large vaporization area is installed for generating a large quantity of condensed water.

Particularly, in order to enhance condensation of water, the external surface of the vaporizing unit 207 is coated with silicon.

In the present invention, the indoor unit 200 of the cooling apparatus for making drinkable water with condensed water that generates at the external part of the vaporizing unit 207 comprises: a water collecting vessel 220, two filtering units 230, 231, two moisture generating units 240, 241, a condensed water storage container 250, a

pump 260, a water storage container 270 and a control circuit (not shown).

At this time, the water collecting vessel 220 is horizontally extended in a rectangular shape, correspondingly with the width of the vaporizing unit 207. The water collecting vessel 220 is fixed at the inner surface of the housing 208 to be arranged under the vaporizing unit 207. At the draining outlet of the water collecting vessel 220, a cover 222 is hinged to be opened or closed by a float 221 having a water level controlling string. The cover 222 of the float 221 usually keeps the draining outlet shut, but it opens the draining outlet when a predetermined quantity of condensed water is collected to the length of the water-level controlling string.

In addition, the two filtering units 230, 231, as shown in Figs. 4A and 4B, are respectively constructed with two-level water-purifying filter and three-level water-purifying filter. At this time, the first filtering unit 230, as shown in Fig4A, is piped to flow the condensed water through the bottom portion of the above-described water collecting vessel 220. The first filtering unit 230 as such has a vertical cylinder 232, which is divided by a filtering sponge pad 233 into two parts filled with various filtering materials, one being filled with activated carbon 234 for filtering dirt and dust and the other with zeolite 235 for filtering organic matters. As a result, the first filtering unit 230 eliminates dirt, dust and organic matters out of condensed water that flows under the gravity, so as to purify the condensed water into clean, drinkable water for keeping a room filled with clean, humid air.

As shown in Fig. 4B, the second filtering unit 231 described above has a vertical cylinder 237, being identically shaped to the first filtering unit 230, which is divided by filtering sponge pads 233', 233" into three parts filled with various filtering materials, such as activated carbon 234', zeolite 235' and nitric cellulose membrane 238. At this time, the nitric cellulose membrane is finely textured in 0.22μm, filtering out microbes and bacteria.

In addition, as shown in Fig. 3, the two moisture generating units 240, 241 are respectively fixed at one side over the condensed water storage container 250 and installed at the internal portion of the condensed water storage container 250 under the first moisture generating unit 240. Both of the moisture generating units 240, 241 have vibration plates to generate moisture as they vibrate in ultrasonic waves by piezo-electric effect. In addition, both of the aforementioned moisture generating units 240, 241 have water-level probing switches 243, 244 similar to general floating switches. Particularly, the first water-level probing switch 243 performs the first and second relay operations depending upon whether or not moisture remains in the first moisture generating unit 240, thereby opening or closing a draining outlet 242 of the first moisture generating unit 240. The first water-level probing switch 243 turns on/ off the first and second moisture generating units 240, 241 in reverse.

Furthermore, the second water-level probing switch 244 performs the second relay operations depending on whether or not moisture remains in the second moisture generating unit 241, thereby opening or closing an inlet 244 of the second moisture generating unit 241. Both of the moisture generating units 240, 241 are respectively piped to a moisture supplying pipe 245 having separate tubes. A nozzle 246 is fixedly formed at the lower portion of the exhaust outlet 201 of the indoor unit 200.

The rectangular condensed water storage container 250 is fixed on the bottom surface of the housing 208 of the indoor unit 200 to temporarily store the condensed water after completing all the filtering steps. One side of the condensed water storage container 250 is connected with the draining outlet 242 of the second moisture generating unit 241 and an extension pipe 271 of the water storage container 270 at the same time. At this time, a third water-level probing switch 274 is assembled at the draining side of the extension pipe 271. The third water-level probing switch as such probes the level of the condensed water in the condensed water storage container 250 to

control operations of the pump 260.

In addition, the pump 260 plays a role to flow toward the second filtering unit 231 the condensed water after being filtered once under a predetermined magnitude of water pressure in the condensed water storage container 250. Particularly, over the pump 260 is the second filtering unit 231. Since the water filled in the condensed water storage container 250 flows upwards, a plurality of filtering materials prevent various kinds of dirt or organic matters from blocking the water conveying pipe 270 or passing to the drinkable water storage container 270.

The second filtering unit 231 is piped with the drinkable water conveying pipe 272. After being filtered by the second filtering unit 231 at the second time, the clean, drinkable water is stored in the drinkable water storage container 270.

At this time, the drinkable water storage container 270 may be attached and detached to easily carry around the clean, drinkable water. It can also be folded or unfolded to store as much drinkable water as possible as an important necessity to keep people alive in emergencies such as in wrecked ship, breakdown automobile or crashed plane, in which a cooling apparatus for making drinkable water is assembled.

The drinkable water storage container 270 as such is vertically arranged behind the indoor unit 200, being able to be folded or unfolded in the horizontal direction. Such drinkable water storage container 270 is designed to efficiently control its storage capacity in volume, usually being folded to minimize the area taken by the indoor unit 200, but being unfolded to enlarge its maximum capacity to store as much drinkable water as possible. In the drinkable water storage container, general quick couplers 273 are respectively assembled at the top and bottom parts of the drinkable water storage container that are respectively connected with the extension pipe and the drinkable water supplying pipe in one-touch type operations. The pipes 271, 272 having spring-like tension are inserted into the drinkable water storage container 270, thereby opening

a water supply route. On the contrary, the pipes 271, 272 are detached out of the drinkable water storage container 270, thereby closing the water supply route. The drinkable water storage container 270 thus constructed stores drinkable water when the indoor unit 200 starts its operation, but it also can be detached with the quick couplers 273 and conveniently carried out to a place where drinkable water is needed.

Hereinafter, installation and operations of the push-cock 210 to be used for obtaining drinkable water are described in detail.

As shown in Figs. 6A and 6B, the push-cock 210 is piped with the drinkable water supplying pipe 272 for directing the water supply route. The push-cock 210 has a bent drain tube 212 connected to a protruded part of a 'T'-shaped prefabricated cock member 211. At this time, the cock member 211 and the drain tube 212 are connected in their rectangular cross-section. In addition, a push button 203 is attached to increase a user's convenience.

As shown in Fig. 6A, under the drain tube 212 of the push-cock 210 a supporting jaw 213 is included for elastically returning to the original position of the push-cock 210 by elasticity of springs 214 after the push-cock 210 being slid in the horizontal direction. The supporting jaw 213 has an integrally protruded bar 215. The protruded bar 215 of the spring supporting jaw 213 is coupled with a spring mounted member 218 to control the push switch 216 of the cock member 211. Furthermore, the internal end of the drain tube 212 is blocked in a rectangular flange with jaws being formed around its frame to prevent the drain tube 212 from sliding out of the cock member 211. In addition, a rubber blocking member 219 is positioned just outside of the internal edge of the drain tube 212. The other internal edge of the drain tube 212 is formed open. A rubber rectangular sealing rod is attached inside of the rectangular flange-shaped edge.

Besides, the cock member 211 is bolted at its upper and lower flange-shaped

portions, and O-rings 217 are inserted at an internal diameter of the protruded part of the cock member 211 for refraining water from leaking when the push-cock 210 is sliding.

As shown in Fig. 6B, the drain tube 212 of the push-cock 210 slides inwards to the cock member 211 when a user presses the push button 203 in a horizontal direction (c). The drain tube 212 as such stops its sliding movement when the rubber blocking member 219 contacts the internal side of the cock member 211. At this time, the drain tube 212 moves along with the rubber blocking member 219 to let the drinkable water (d) flow into the water supplying pipe 272. At the same time, the end of the protruded bar 215 formed with the spring supporting jaw 213 contacts the push switch 216 to operate the pump that is connected with the push switch 216. Accordingly, the drinkable water (d) having a high pressure increased by the pump flows along the drinkable water supplying pipe 272, changes its flowing route toward the drain tube 212 and finally discharges out. In addition, if the user releases the push button 203 of his pressing force, the drain tube 212 returns to its original position by the elasticity of springs 214.

Now, circuits of the aforementioned cooling apparatus for making drinkable water of the present invention will be described in detail.

As shown in Fig. 7, the control circuit includes magnetic connector 281 to control one side of circuit line connected in parallel with power supply 209 of the indoor unit 200. At the magnetic connector 281 is connected with a red lamp 282 that turns on to indicate an occurrence of abnormal operational status. The circuit line connecting both of the magnetic connector 281 and lamp 282 is also connected with a water-level probing switch 294 that refrains water from flowing out even when motor is in its abnormal operational status.

Furthermore, the electric relays 283, 284, 285, 287 are wired for selective

switching operations, when power is supplied, for instance, detecting humidity of the moisture generating unit and water-level of the extension pipe with water-level probing switches 243, 244, 274, and tuning on/ off the push switch 216 in sliding operations of the push-cock. Another green lamp 286 that turns on to indicate an operational status of the pump, and the humidifying switch 288 controls supply of power to the moisture generating units.

At this time, if the humidifying switch 288 turns on, the first and second electric relays 283, 384 operates in accordance with a position (left or right) of the first water-level probing switch 243 close to the first moisture generating unit. If no water remains in the first moisture generating unit, the second moisture generating unit initiates its operations. If no water remains in the first and second moisture generating unit, both of them stop their operations. Then, the push switch 216 turns on to operate the pump. At this time, if no water remains in the condensed water storage container, the first terminal "s" of the third water-level probing switch 274 stops operations of the pump. If a large quantity of water remains in the condensed water storage container, the second terminal "t" of the third water-level probing switch 274 initiates operations of the pump. Besides, if there is any operational trouble in the pump, the water overflow prohibition switch 294 stops all operations of air conditioner, moisture generating units, pump and humidifier, thereby enabling the red lamp 282 to turn on immediately. On the other hand, the green lamp 286 turns on only when the pump is in its operational status.

Then, operational procedures of the cooling apparatus for making drinkable water of the present invention will be described in detail.

As shown in Fig. 8, a user turns on power supply of the air conditioner. Then, the user also turns on the humidifying switch (not shown) of the display panel. At this time, carrier gas cools down by the compressing and condensing units of the outdoor unit 100. The cooled carrier gas is supplied to the vaporizing unit 207 of the indoor unit

200. As the cooling fan 206 circulates to suck in air through the suction inlets 204 of the indoor unit 200. The sucked-in air is heat-exchanged to cool down and discharge out through the exhaust outlet 201 of the indoor unit 200.

At this time, the moisture contained in the air surrounding the vaporizing unit 207 is condensed by relative temperature differences, thereby turning into condensed water. The condensed water flows downwards under the vaporizing unit 207 to the condensed water collecting vessel 220. Thus, a predetermined quantity of the condensed water collected in the water collecting vessel 220 is stored by the cover 222 that can be opened or closed by float 221 having a string. Only when a predetermined quantity of condensed water is stored, the cover 222 is opened by float 221 so as to enable the condensed water to flow into the first filtering unit 230 along the draining outlet of the water collecting vessel 220. The second filtering unit 230 further performs filtering processes thoroughly enough to make clean moisture. The well-filtered condensed water flows into the first moisture generating unit 240. At this time, the first water-level probing switch 243 of the first moisture generating unit 240 closes the draining outlet 242 to initiate operations of the first moisture generating unit 240 as the water slowly fills in the first moisture generating unit 240. Therefore, the first moisture generating unit 240 generates clean moisture, which moves through the moisture supplying pipe 245 toward the exhaust outlet 201 of the indoor unit 200. At this time, the moisture made by vibrating cool condensed water in its uncongealed state mixes with cool air passing through the exhaust outlet 201 and moves into the room.

As shown in Fig. 9, in order to dehumidify indoors of a room by using the air conditioner in its operational state, the user turns off the humidifying switch to stop operations of the first moisture generating unit 240. If filtered water continuously fills up to the maximum water-level of the first moisture generating unit 240, the first water-level probing switch 243 opens the draining outlet 242. Accordingly, the filtered water

flows into the condensed water storage container 250. Besides, the second water-level probing switch 244, that operates in reverse to the fist water-level probing switch 243, turns off the second moisture generating unit 241. Then, the third water-level probing switch 274 detects the water-level of the filtered water in the condensed water storage container 250 and initiates operations of the pump 260. After being filtered at the second filtering unit 231 in pressure by the pump 260, the condensed water turns into clean, drinkable water. The clean, drinkable water continuously moves upwards by the water pressure of the pump 260, thereby filling up the drinkable water storage container 270.

By pushing the drain tube 212 of the push-cock 210 to the horizontal direction (c), the user can obtain the drinkable water. The drinkable water storage container 270 can also be expanded to store a large quantity of drinkable water if drinkable water is not frequently consumed out of the drinkable water storage container 270.

Furthermore, as shown in Fig. 10, in order to humidifying indoors of a room by using the air conditioner in its operational state, the user turns on the humidifying switch. At this time, if only a small quantity of condensed water is generated by the vaporizing unit 270 not to sufficiently supply condensed water to the first moisture generating unit 240 and condensed water storage container 250, the second and third water-level probing switches 244, 274 turn on the second moisture generating unit 241, enabling the water filling in the drinkable water storage container 270 to flow into the condensed water storage container 250 and the second moisture generating unit 241. Accordingly, the second moisture generating unit 241 starts generating moisture, which further moves through the moisture supplying pipe 245 toward the exhaust outlet 201 of the indoor unit 200.

Then, applications of the cooling apparatus for making drinkable water of the present invention will be described with reference to Figs. 11 and 12.

As shown in Fig. 11, the cooling apparatus for making drinkable water of the present invention can be applied to a variety of auto-vehicles such as cars, trucks, buses, heavily equipped vehicles and the like. In other words, the cooling apparatus for making drinkable water can be fabricated as follows: making a condensed water collecting vessel 322 in size, correspondingly with a vaporizing unit 307 of a basic cooling system of an automobile; enabling a drinkable water supplying pipeline 372 connecting first filtering unit 330, pump 360 and second filtering unit 331 to pass through gauging panel positioned close to the front seat next to the driver's; and keeping the push-cock 310 connected to the drinkable water supplying pipeline 372 protruded to the front side of the gauging panel positioned close to the front seat next to the driver's. The drinkable water fills up to be stored at a folding drinkable water storage container 370, which can also be attached or detached from the drinkable water supplying pipeline 372 with a quick coupler 373.

In addition, the cooling apparatus for making drinkable water thus constructed can be applicable to a small air conditioner generally used in desert, island, ship or plane. With internally equipped vaporizing unit, it becomes possible to make and store drinkable water in any place to be used, if necessary, for instance, as drinkable water for passengers in a ship.

As shown in Fig. 12, the cooling apparatus for making drinkable water can also be used for a warehouse type cooling system.

The aforementioned cooling apparatus for making drinkable water is installed on a wall 401 of a warehouse 400 with a supporting bracket 403. A frame 402 of the cooling apparatus of the present invention is partially inserted at a duct opening 409 of the wall 401 of the warehouse 400.

The cooling apparatus for drinkable water assembled as described above is applied to a general warehouse type cooling system 102.

At this time, in the general warehouse type cooling system 102, the carrier gas is compressed by the compressing unit 103 and then condensed by the condenser 104. In other words, the air supplied by a blower 408 allows a high temperature of carrier gas to heat-exchange into a low temperature of carrier gas.

Particularly, the warehouse type cooling system for making drinkable water additionally includes a coil type heating wire 405 at the condensing unit 104 and a second duct 491 with an end of it being penetrated with the first duct 490 where the condenser 104 is installed.

In addition, the other end of the second duct 491 is penetrated with a part where the vaporizing unit 407 is installed for inducing the air heated by the condenser 104 and the coil type heating wire 405 to the vaporizing unit 407.

In other words, the first and second ducts 490, 491 and the coil type heating wire 405 sequentially supply heated air toward the vaporizing unit 407, helping the vaporizing unit 407 to condense water and to eliminate moisture contained in the supplied air for a function of dehumidification.

Also, a cooling fan 406 moves out room air and hot air to the vaporizing unit 407, in which the air is heat-exchanged and moved into the warehouse 400.

In order to perform processes of making condensed water into potable water, the cooling apparatus for making drinkable water is constructed with water collecting vessel 422, first filtering nit 430, pump 460, second filtering unit 431 and push-cock 410 sequentially piped with a drinkable water supplying pipeline 472 in its frame 402. At this time, the drinkable water supplying pipeline 472 is extended into the internal part of the warehouse 400 and connected to a foldable drinkable water storage container 470 with a quick coupler.

Therefore, the cooling apparatus for making drinkable water, applicable to a warehouse, carries out all the functions of cooling a room, making drinkable water and

dehumidifying at the same time.

In consequence, there are advantages in the cooling apparatus for making drinkable water of the present invention as follows:

The apparatus can generate a large quantity of moisture rapidly and continuously even after two moisture generating units, a plurality of water-level probing switches and water storage containers have been operated for a predetermined number of hours at their maximum operational efficiency.

The apparatus also can store continuously condensing water even when the cooling apparatus stops its humidifying process.

The apparatus helps to generate clean moisture and make potable water by purifying condensed water twice while it passes through two filtering units and a push-cock to turn into drinkable water.

The apparatus can quickly generates moisture with a first moisture generating unit even at the initial state of the cooling processes.

The apparatus can differentiates humidifying and dehumidifying functions with a humidifying switch.

The apparatus includes water-level probing switches to prevent overload of major parts of the apparatus like moisture generating units, thereby minimizing occurrences of malfunction.

While the invention has been described with accompanying drawings in terms of a preferred embodiment, those skilled in the art will recognize that the invention can be practiced with a variety of modifications and imitations within the spirit and scope of the appended claims.

What is claimed is:

1. A cooling apparatus with indoor and outdoor units to circulate carrier gas comprising:

a rectangular water collecting vessel disposed under a vaporizing unit for collecting water condensed by the vaporizing unit of an indoor unit;

a first filtering unit vertically piped under the condensed water storage container;

first and second moisture generating units piped under the first filtering unit for generating moisture by vibrating the condensed water filtered once by the first filtering unit;

a rectangular condensed water storage container piped under the second moisture generating unit and a drinkable water storage container;

a second filtering unit piped for thoroughly filtering the condensed and once filtered water of the condensed water storage container in pressure to a pump; and

a push-cock protruded to the front side of the indoor unit for draining out clean, drinkable water thoroughly filtered by the second filtering unit or for changing the direction of flowing water to the drinkable water storage container.

2. The apparatus, as defined in claim 1, wherein the first and second filtering units have vertical cylinders divided by filtering sponge pads and filled with various filtering materials.

3. The apparatus, as defined in claim 1, wherein the first moisture generating unit has a first water-level probing switch electrically connected to a control circuit part for turning ON/OFF in opposite the first and second moisture generating units.

4. The apparatus, as defined in claim 1, wherein the second filtering unit is piped over the pump for preventing blockage of pipes with various kinds of dirt and organic matters by using a plurality of filtering materials while water fluctuates up and down in the condensed water storage container.

5. The apparatus, as defined in claim 1, wherein the external portion of the vaporizing unit is coated with silicon to enhance condensation of water.

6. The apparatus, as defined in claim 1, wherein the draining outlet of the water collecting vessel 220 has a cover hinged to be opened or closed by a float having a water level controlling string.

7. The apparatus, as defined in claim 1, wherein the drinkable water storage vessel is made in a foldable type and vertically arranged behind the indoor unit to be folded and unfolded in the horizontal direction.

8. The apparatus, as defined in claim 1, wherein the first and second moisture generating units are piped with the moisture supplying pipe having separate tubes.

9. The apparatus, as defined in claim 1, wherein a nozzle is fixedly formed at the lower portion of the exhaust outlet of the indoor unit.

10. The apparatus, as defined in claim 1, wherein quick couplers are assembled at the top and bottom portions of the drinkable water storage container respectively connected with the extension pipe and the drinkable water supplying pipe for an one-

touch type operation.

11. The apparatus, as defined in claim 10, wherein a third water-level probing switch is assembled at the draining outlet of the extension pipe to control operations of the pump by detecting the water-level of the condensed water storage container.

12. The apparatus, as defined in claim 1, wherein the push-cock includes a bent drain tube is connected to the drinkable water supplying pipe with a T-shaped prefabricated cock member to be able to slide back to its original position in elastic force of a spring.

13. The apparatus, as defined in claim 12, wherein the internal end of the drain tube is blocked in a rectangular flange with a jaw being formed around its frame to prevent the drain tube from sliding out of the cock member.

14. The apparatus, as defined in claim 12, wherein the push switch is assembled at the push-cock for controlling functions of the pump.

15. The apparatus, as defined in claim 1, wherein a water collecting vessel is made in a size corresponding with that of the vaporizing unit of a vehicle and piped with a drinkable water supplying pipeline which sequentially connects the first filtering unit, pump, second filtering unit and push-cock.

16. The apparatus, as defined in claim 15, wherein the drinkable water storage container is made in a size adequate enough to be attached to the trunk of a vehicle.

17. The apparatus, as defined in claim 1, wherein a heat wire is additionally wound around the condenser piped to allow carrier gas to be supplied to the vaporizing unit for condensation of water in winter.

18. The apparatus, as defined in claim 17, wherein a second duct is connected in the first duct, where the condensing unit is installed, to supply heated air toward the vaporizing unit.

19. The apparatus, as defined in claim 17, wherein the drinkable water supplying pipeline having the water collecting container, first filtering unit, pump, second filtering unit, push-cock and drinkable water storage container is extended to the internal part of the warehouse.

20. The apparatus, as defined in claim 1, which can be placed in ship or plane having a vaporizing unit with functions of producing and storing potable water at the drinkable water storage container and providing drinkable water by detaching only the drinkable water storage container in emergency.

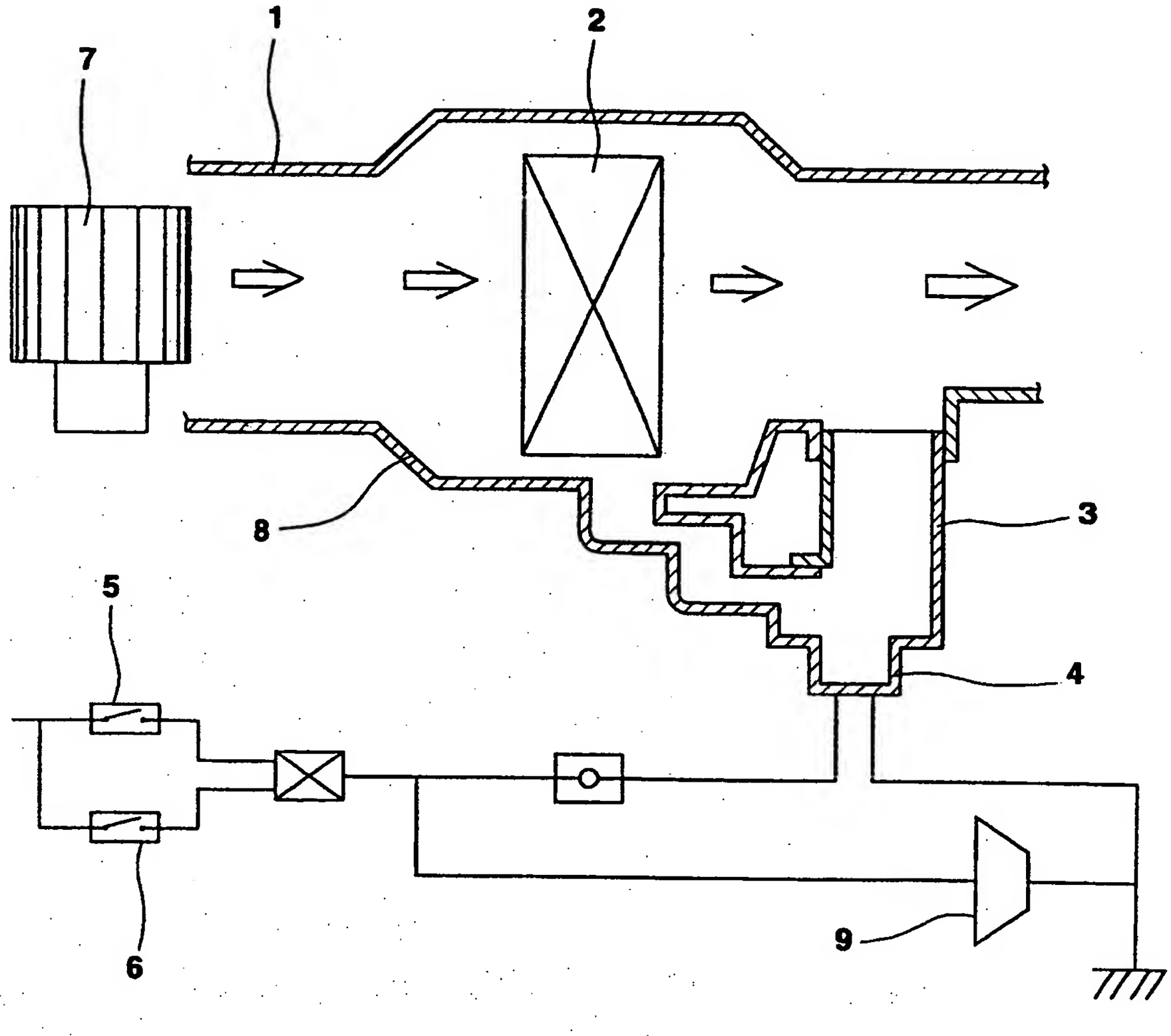


FIG. 1

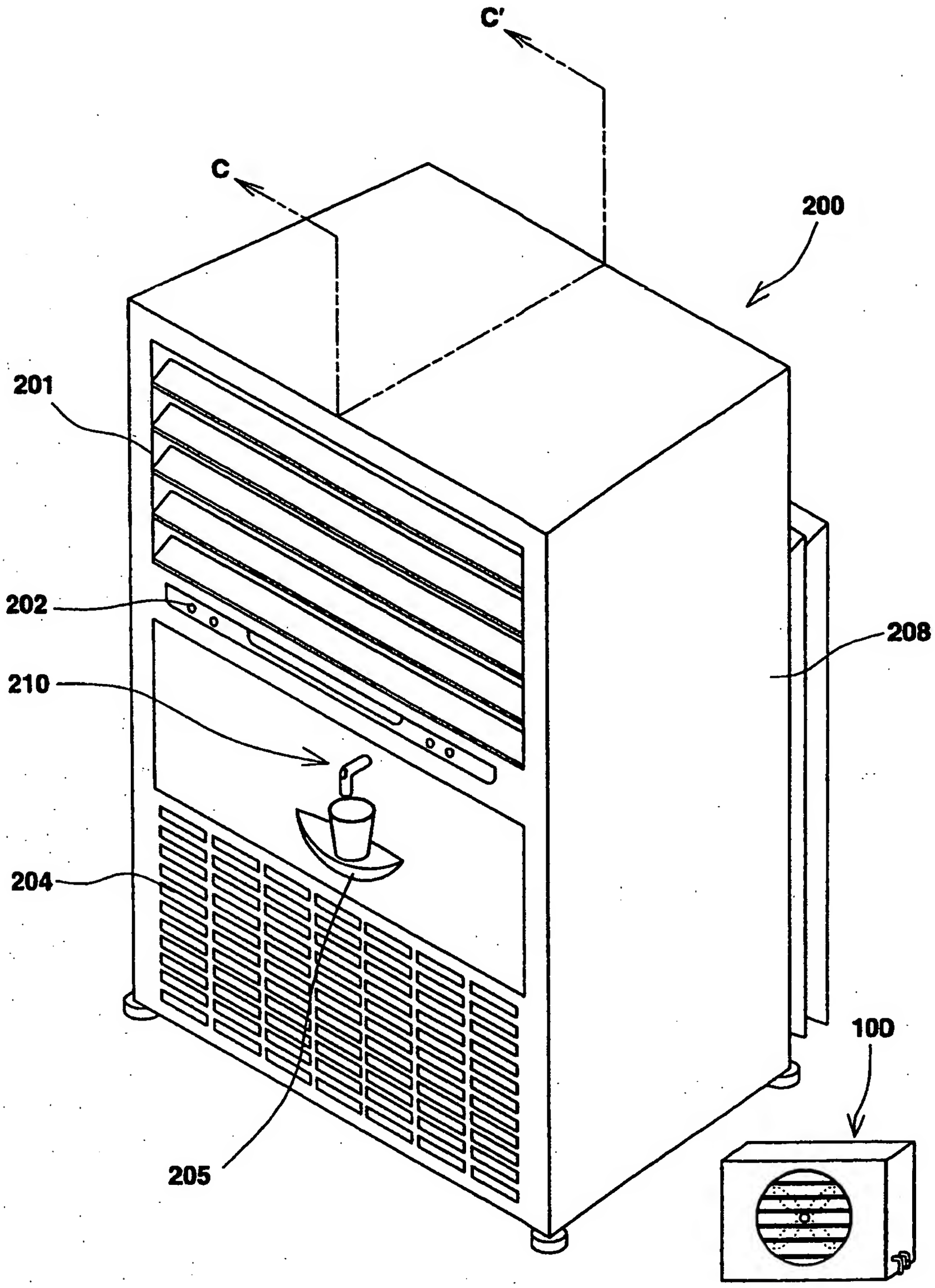


FIG. 2

C-C'

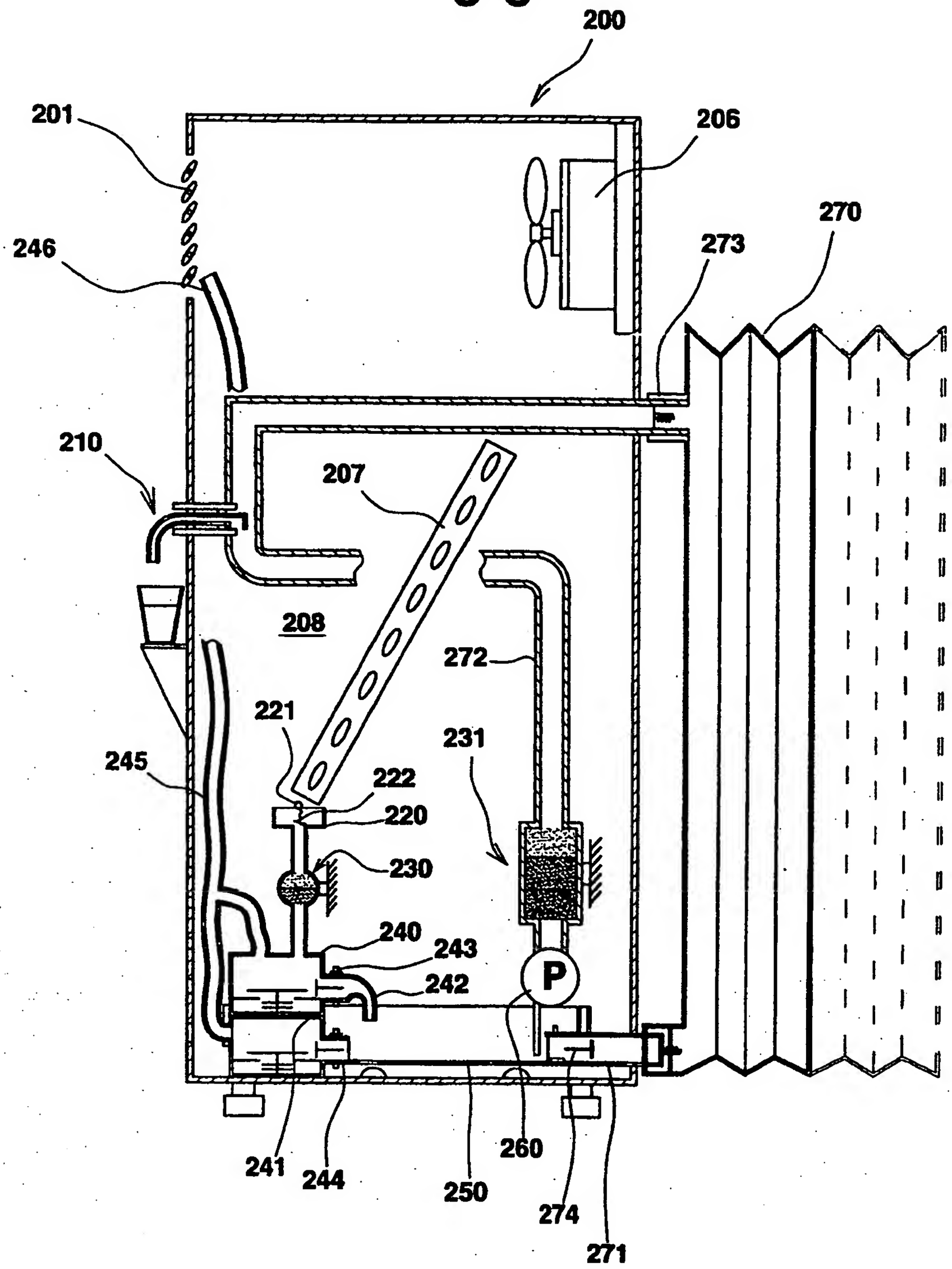

200
201
206
246
270
273
210
207
208
272
221
231
245
222
220
230
240
243
242
P
241
244
250
260
274
271

FIG. 3

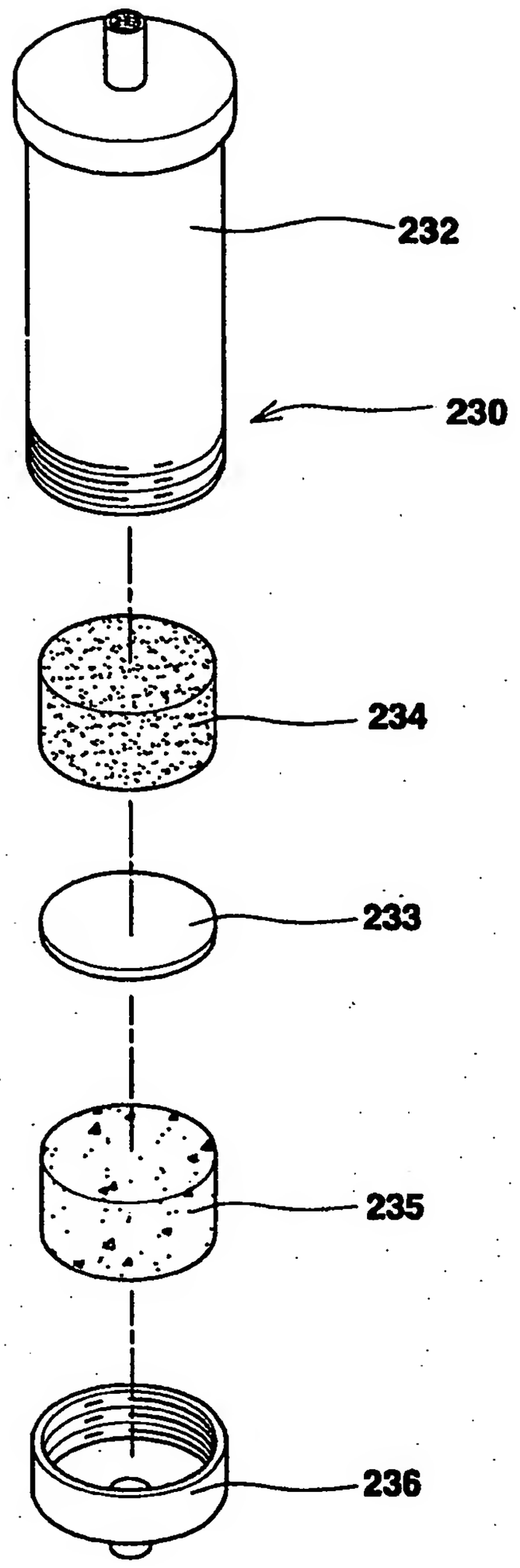


FIG. 4A

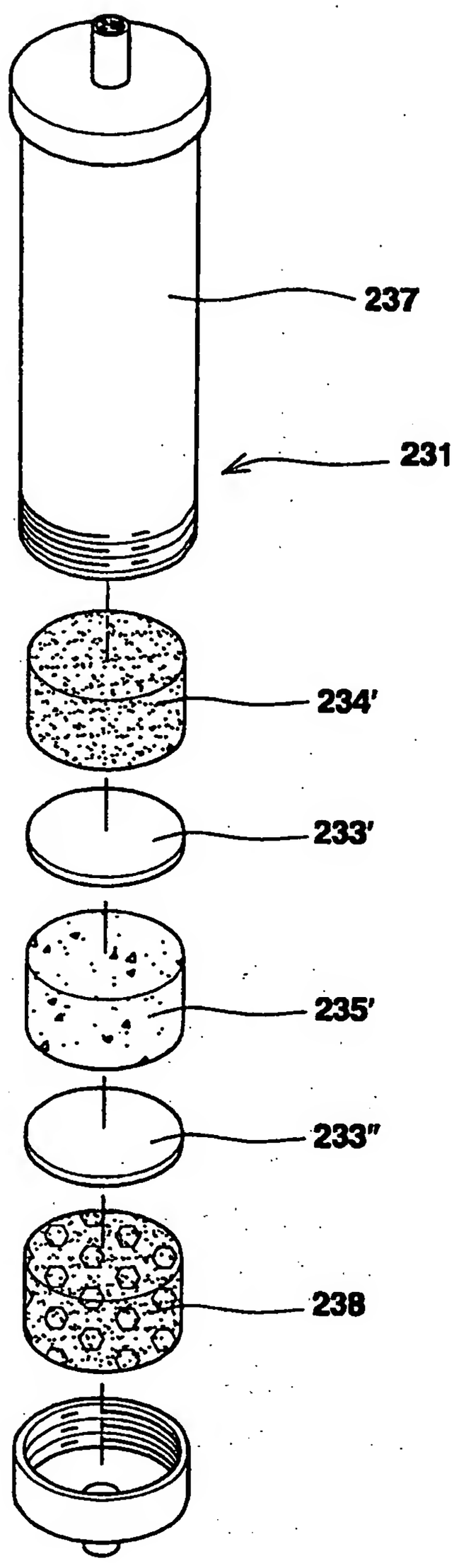


FIG. 4B

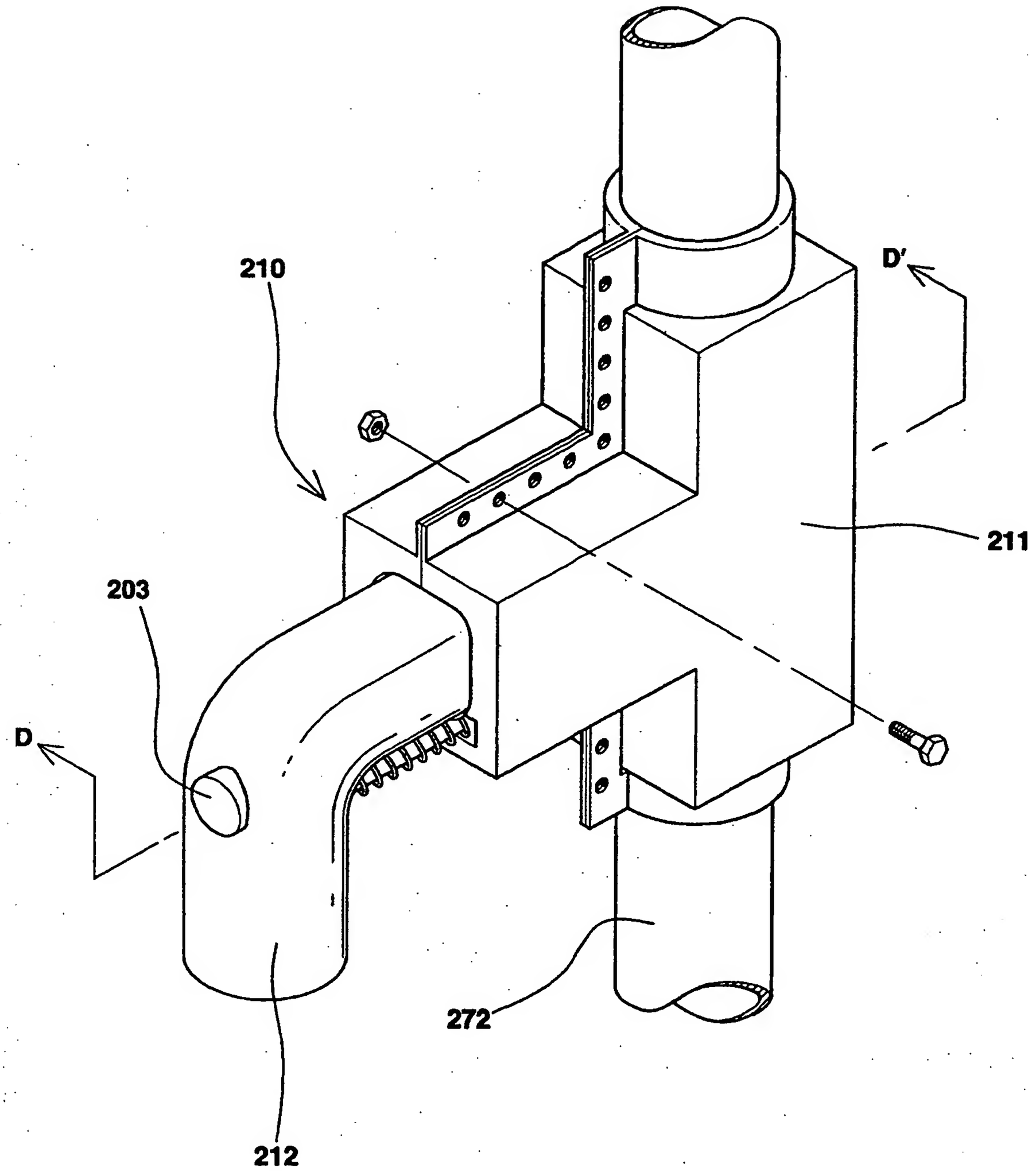


FIG. 5

D-D'

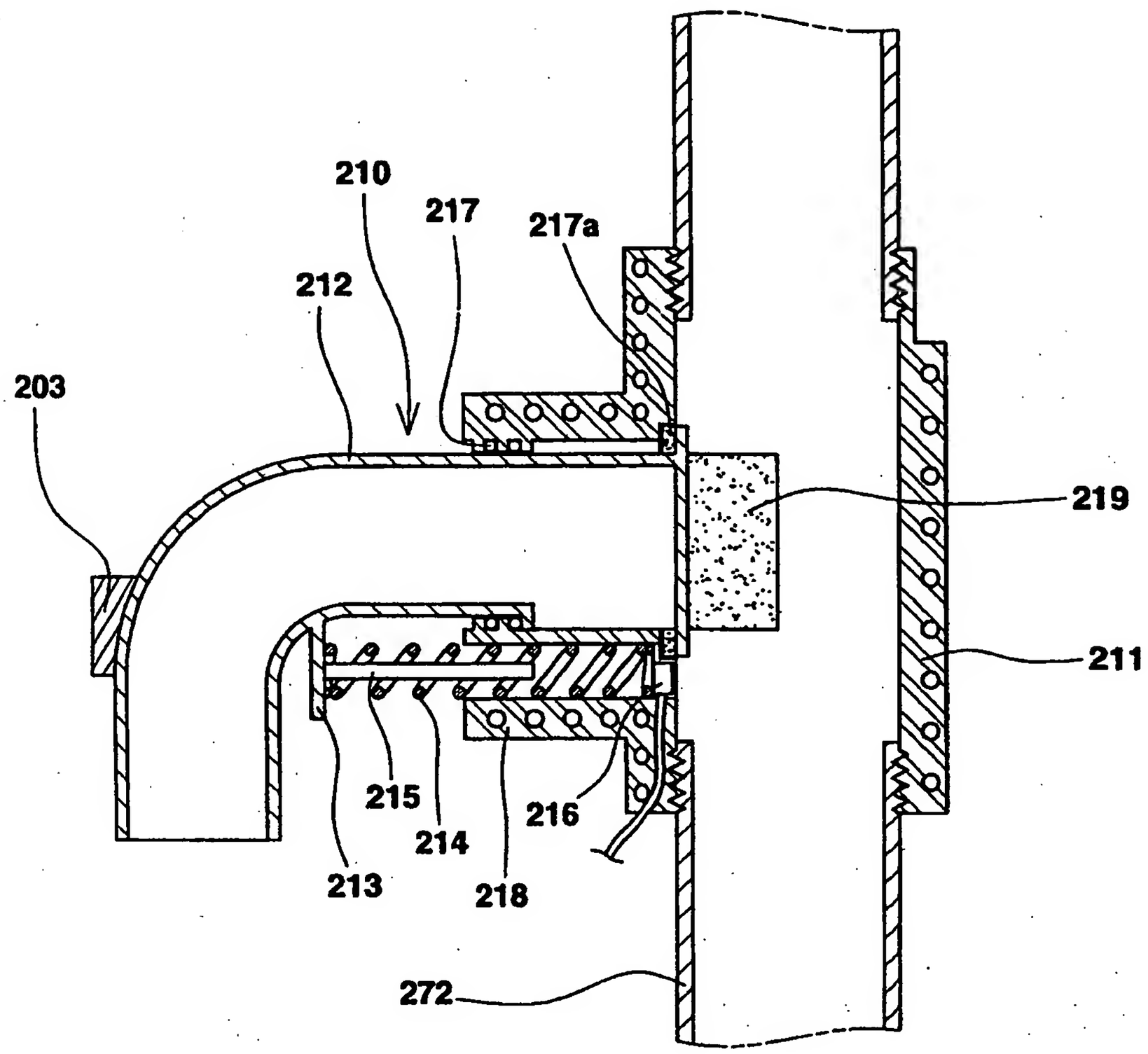


FIG. 6A

D-D'

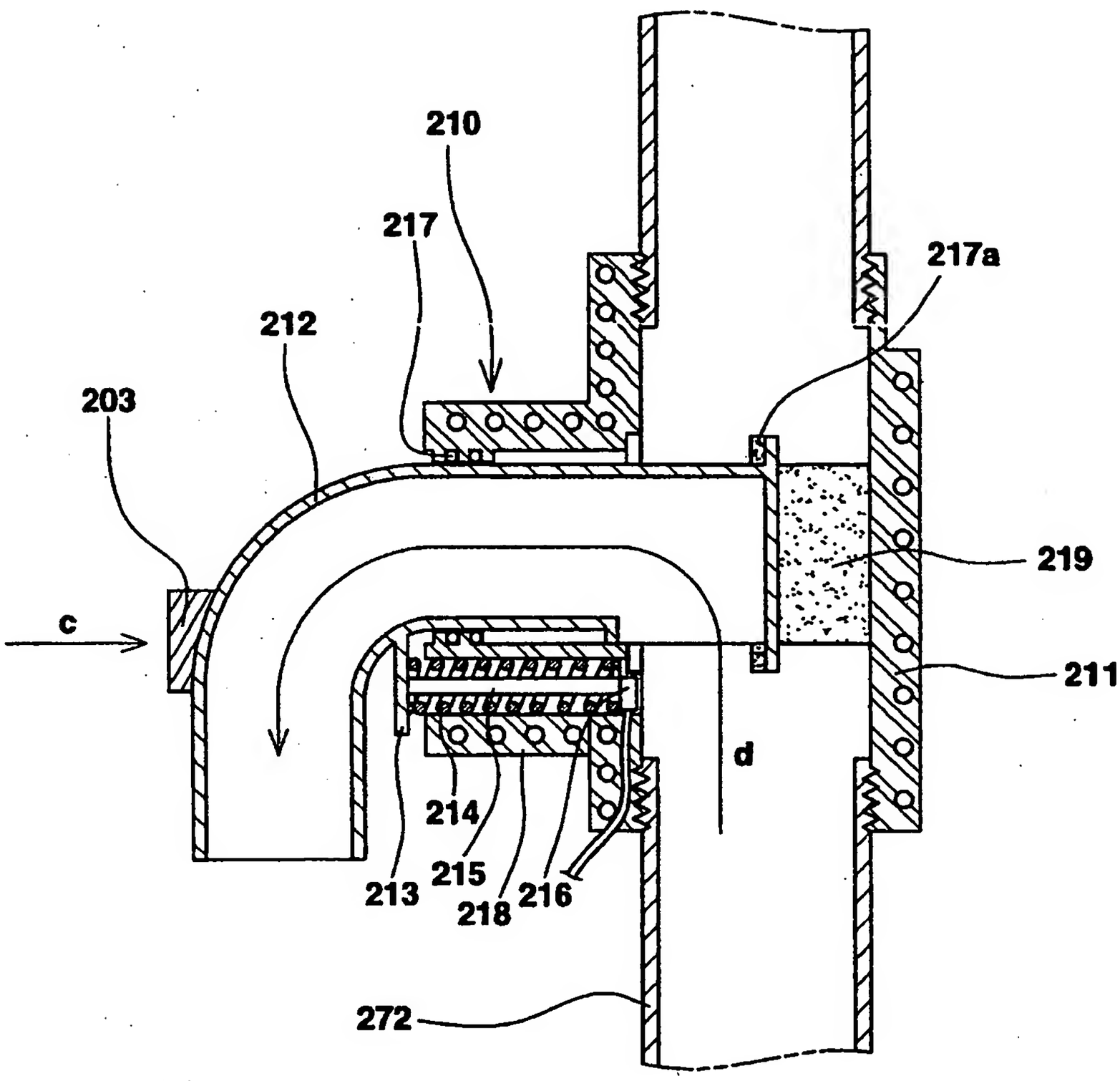


FIG. 6B

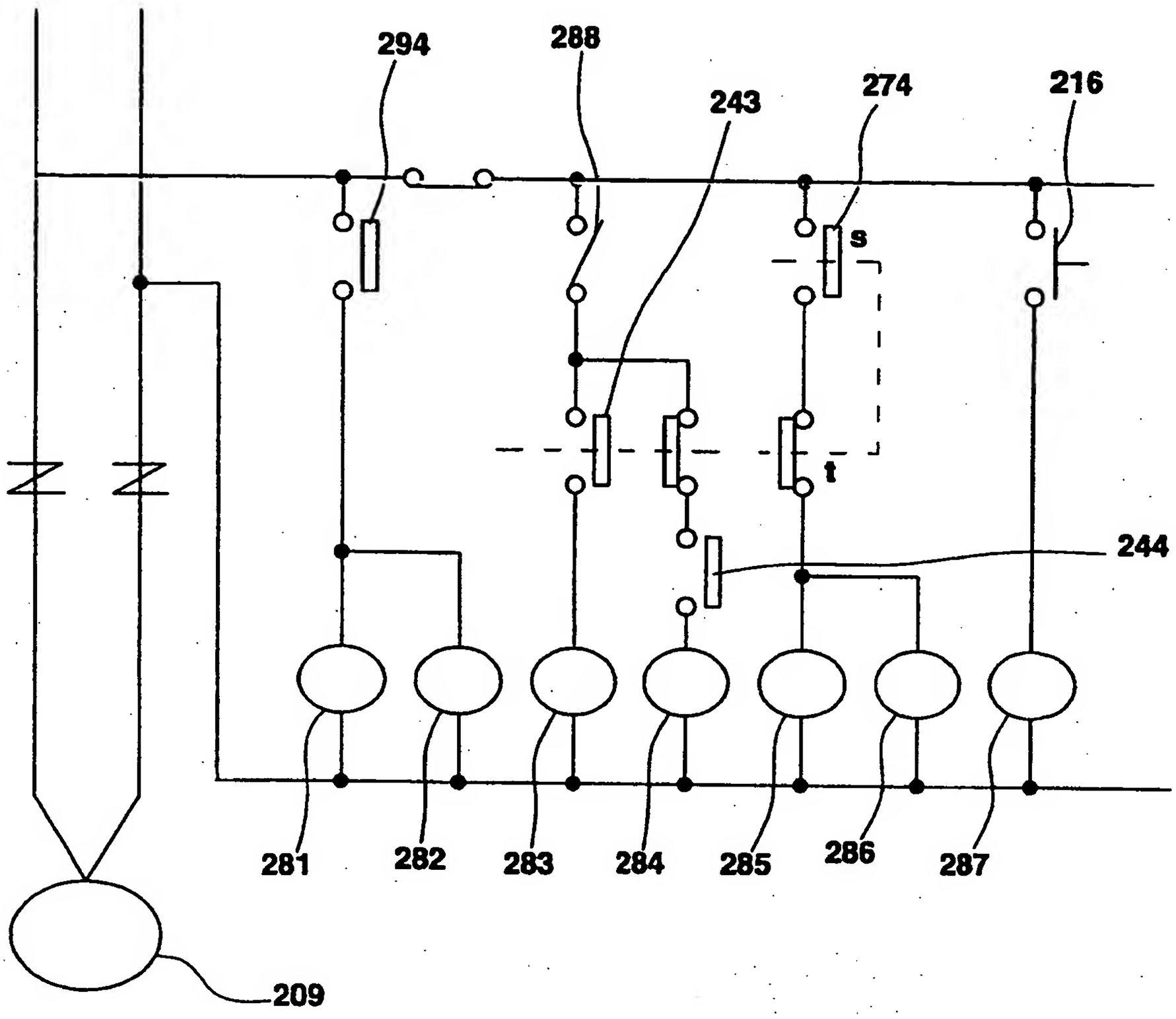


FIG. 7

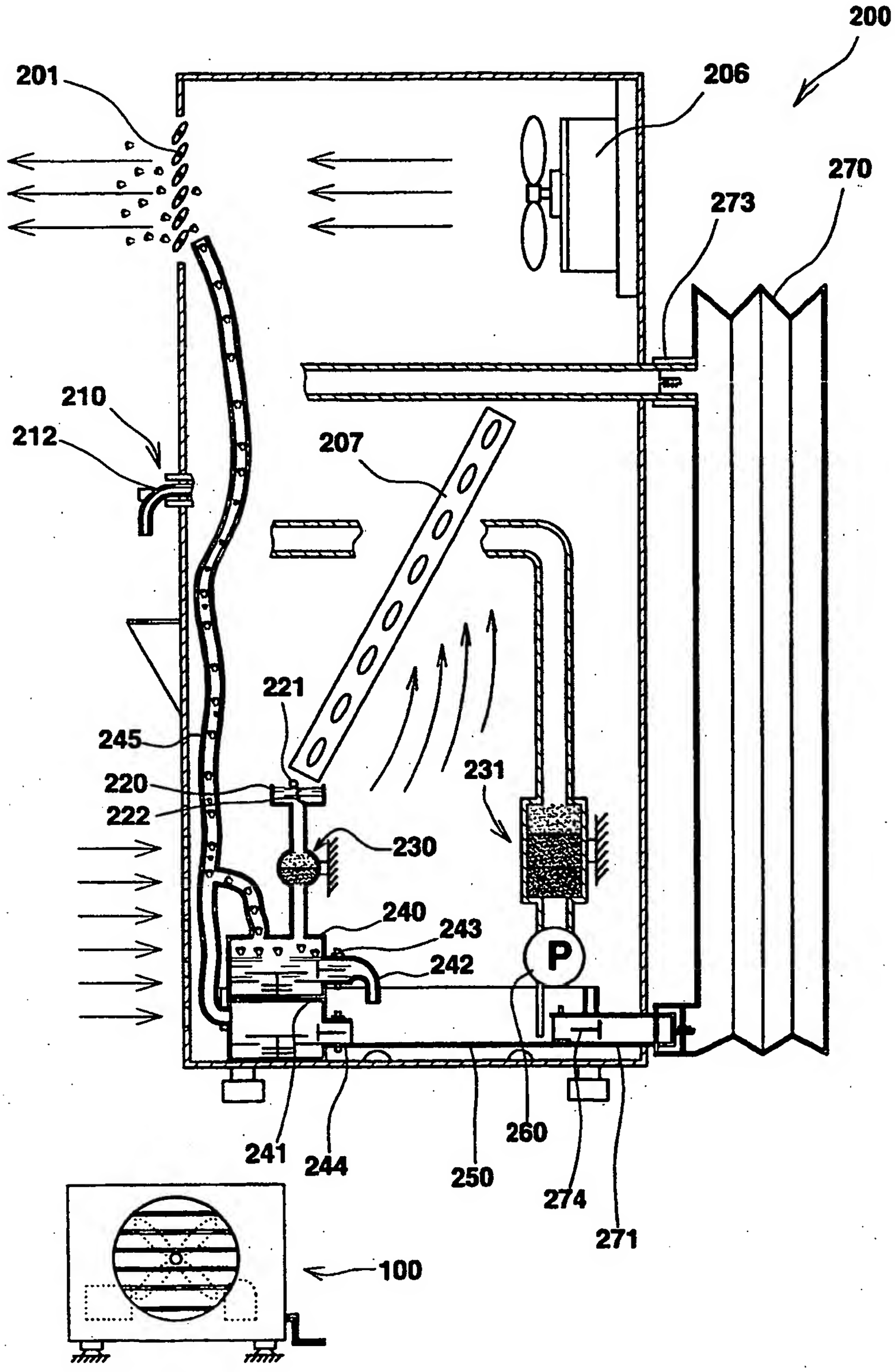

200
201
206
270
273
210
212
207
221
245
220
222
230
231
240
243
242
P
241
244
250
260
274
271
100

FIG. 8

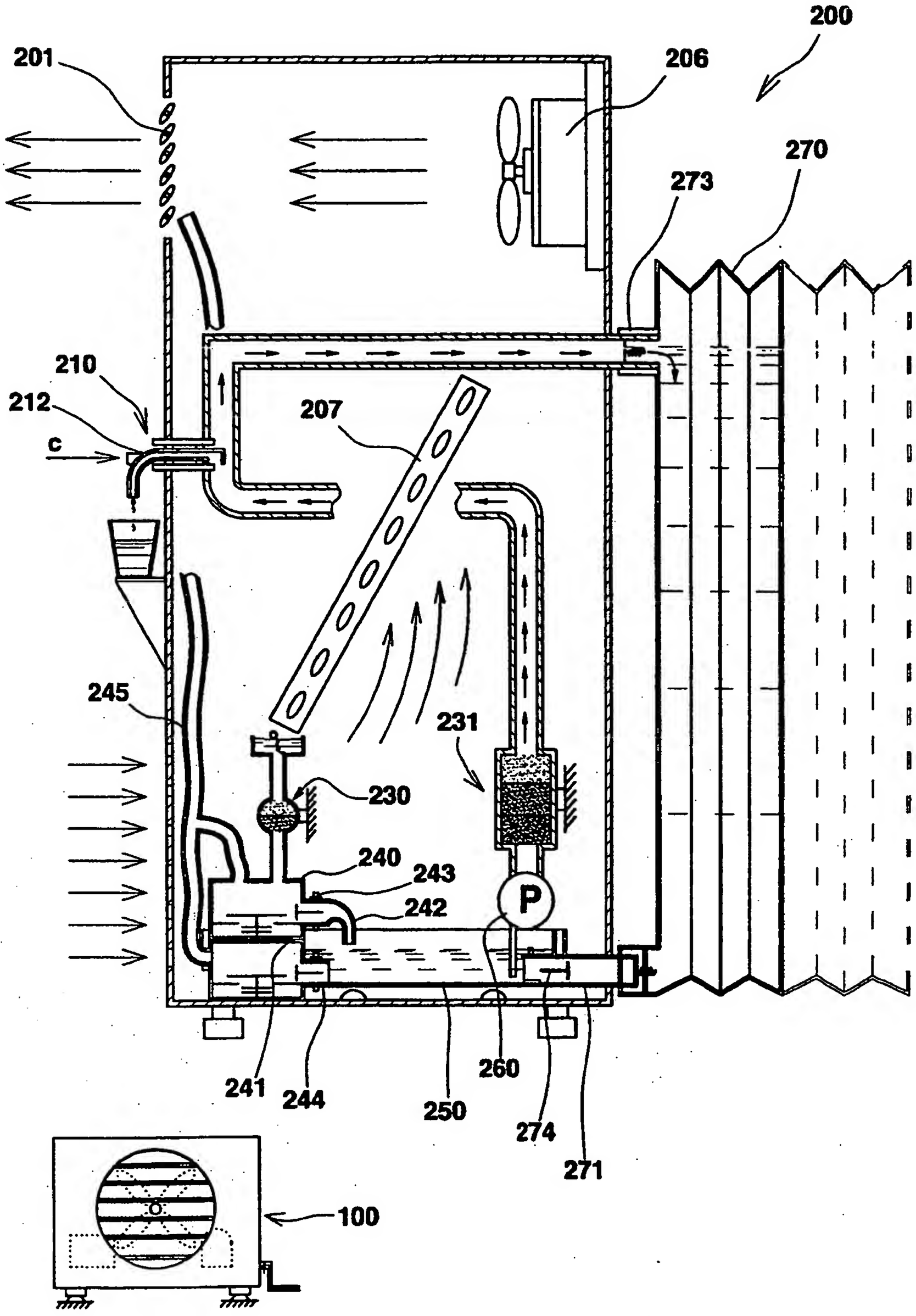

200
201
206
270
273
210
212
C
207
245
231
230
240
243
242
P
241
244
250
260
274
271
100

FIG. 9

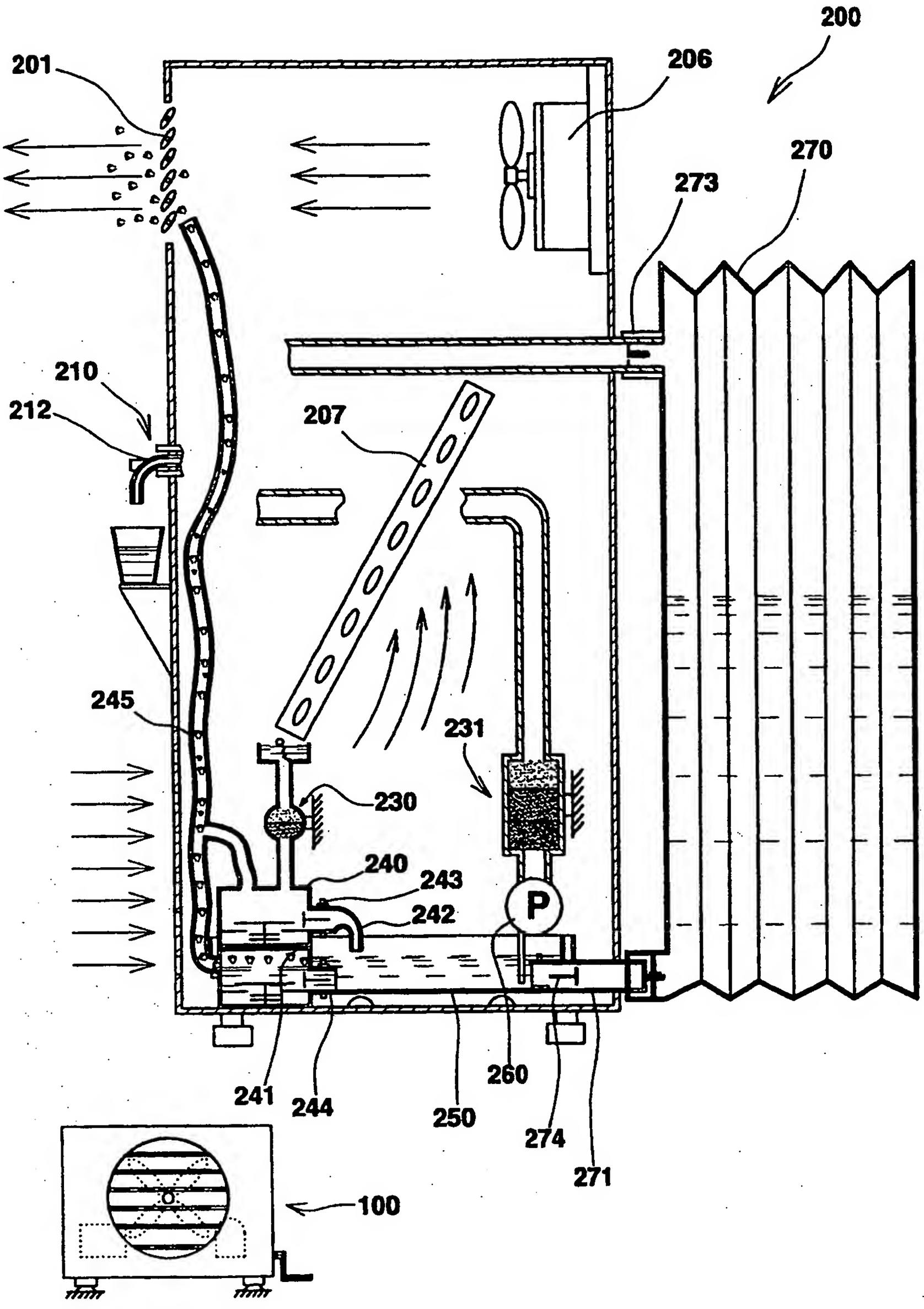

200
201
206
270
273
210
212
207
245
231
230
240
243
242
P
241
244
250
260
274
271
100

FIG. 10

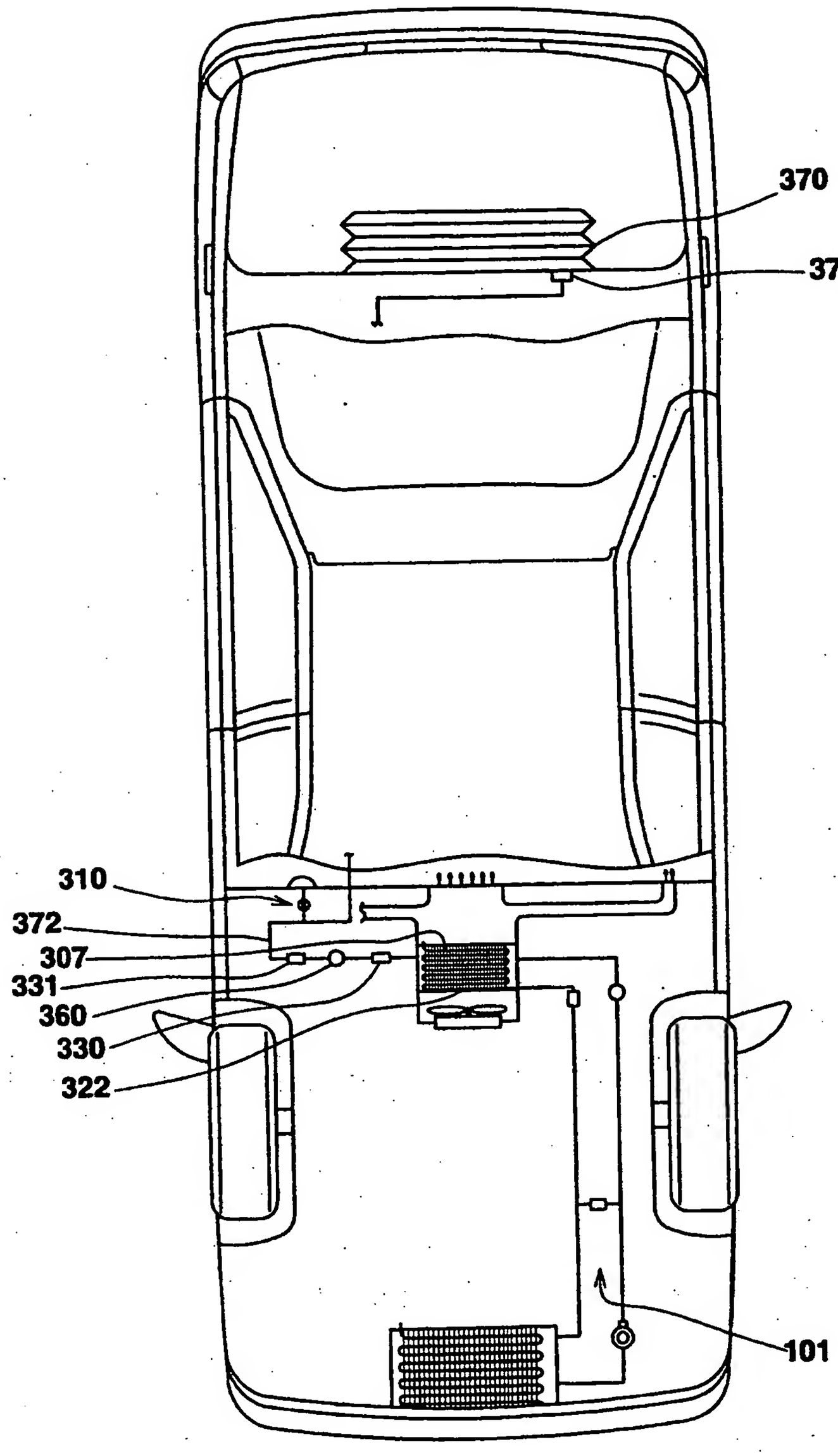


FIG. 11

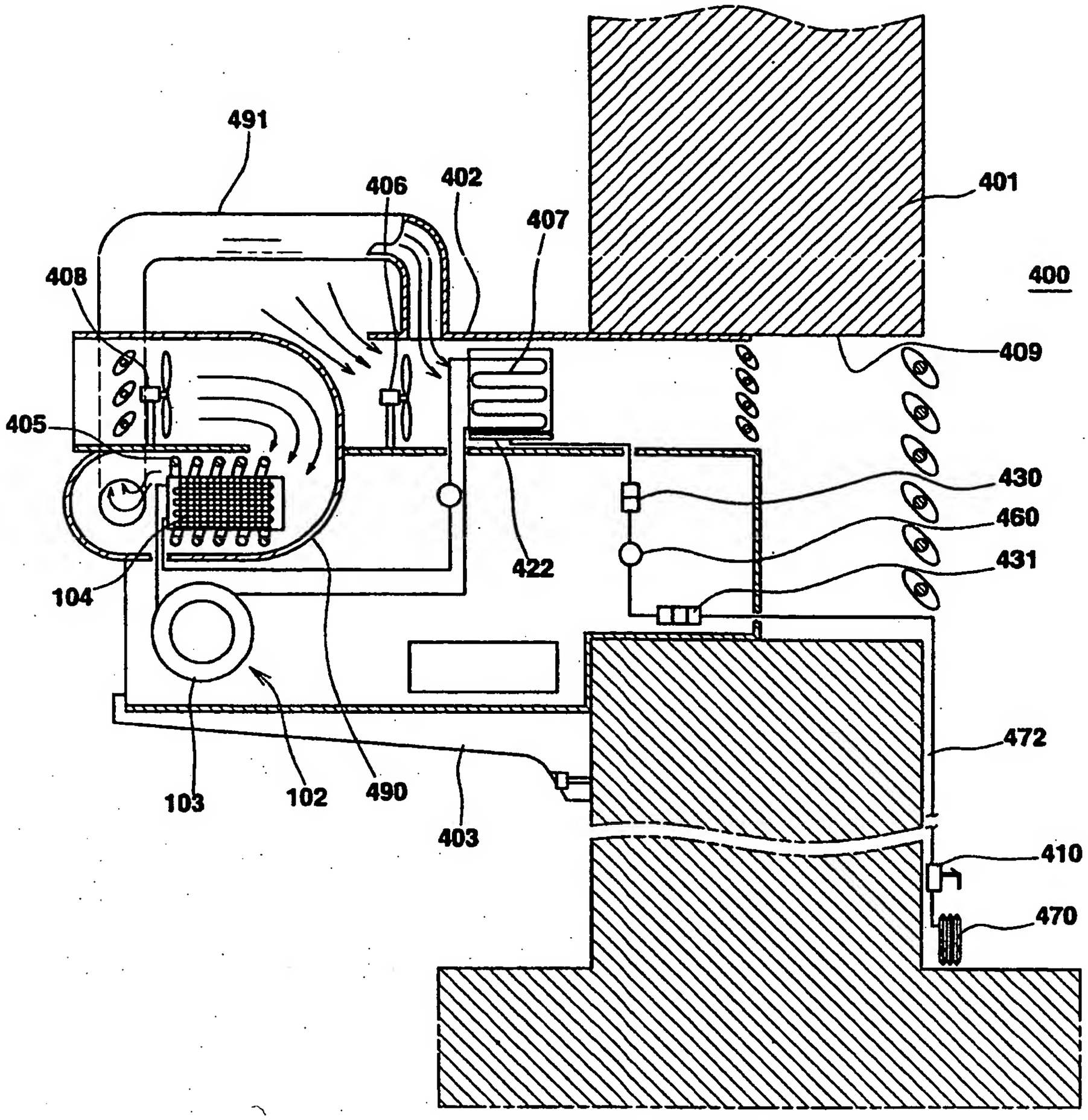

491
406
402
407
401
408
400
409
405
430
460
431
422
104
472
103
102
490
403
410
470

FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 00/00532

CLASSIFICATION OF SUBJECT MATTER

IPC[7]: C 02 F 1/00; E 03 B 3/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[7]: C 02 F; E 03 B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0597716 A1 (DIL SHAM VENTURES) 18 May 1994 (18.05.94) totality.	1-20
A	US 5149446 A (REIDY) 22 September 1992 (22.09.92) totality.	1-20
A	US 5106512 A (REIDY) 21 April 1992 (21.04.92) totality.	1-20
A	US 4255937 A (EHRLICH) 17 March 1981 (17.03.81) totality.	1-20

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
„A" document defining the general state of the art which is not considered to be of particular relevance
„E" earlier application or patent but published on or after the international filing date
„L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
„O" document referring to an oral disclosure, use, exhibition or other means
„P" document published prior to the international filing date but later than the priority date claimed

„T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
„X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
„Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
„&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 July 2000 (10.07.2000)	31 July 2000 (31.07.2000)
Name and mailing adress of the ISA/AT Austrian Patent Office Kohlmarkt 8-10; A-1014 Vienna Facsimile No. 1/53424/535	Authorized officer Koller Telephone No. 1/53424/458

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR 00/00532

Patent document cited in search report			Publication date	Patent family member(s)			Publication date
EP	A1	597716	18-05-1994	CN	A	1094469	02-11-1994
EP	B1	597716	15-07-1998	DE	C0	69319695	20-08-1998
				DE	T2	69319695	11-03-1999
				ES	T3	2119866	16-10-1998
				IL	A0	103729	04-04-1993
				IL	A1	103729	30-03-1995
US	A	5149446	22-09-1992	IL	A0	100644	06-09-1992
				WO	A1	9213623	20-08-1992
				US	A	5106512	21-04-1992
				US	A	5203989	20-04-1993
US	A	5106512	21-04-1992	IL	A0	100644	06-09-1992
				US	A	5149446	22-09-1992
				WO	A1	9213623	20-08-1992
				US	A	5203989	20-04-1993
US	A	4255937	17-03-1981			none	

65643CIP-WO	Multi-Through Hole Testing Plate for High Throughput Screening
65647-WO2	Apparatus and Methods for Parallel Processing of Micro-Volume Liquid Reactions
65648-WO	Concentric Tube Microplate Autosample Interface
65649CIP-WO	Capillary Action Transfer Pins
65663-WO	Assay Apparatus and Method Using Microfluidic Arrays
65663-WO2	Improved Selection Ligation and Amplification Assay
65663CIP-WO	Thermal Cycler for Microfluidic Array Assays
65664-WO	Apparatus and Methods for Droplet Microchemistry
65664CIP-WO	A System and Method for High Throughput Processing of Droplets
65664CIP2-WO	A System and Method for High Throughput Sample Preparation and Analysis Using Column Chromatography
65664CIP3-WO	System and Method for High Throughput Screening of Droplets
65664CIP4-WO	High Throughput Autosampler
65671-WO	Coating Process for Microfluidic Arrays
65672-WO	Nanoliter Array Loading
65689WO	Method and Apparatus for Performing Microassays
65886WO	Apparatus for Assay, Synthesis and Storage, and Methods of Manufacture, Use, and Manipulation Thereof